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ABSTRACT

This study explored whether student generated questions aid learning and, more specifically, whether the effective conditions of learning in this learner controlled situation resemble those which occur when questions are instructor imposed. Sixty-four high school students were paid to serve as subjects in this experiment. These students engaged in tutorials in which they asked each other questions about a biographical passage. Recall was 70 percent for the information related to the student produced questions--whether the student made up the question or answered it. Recall was 50 percent for other information in the same passage. Recall was also 50 percent for the material which the students studied alone. It was concluded that acting as an answerer or questioner did not affect recall for the information which was incidental to the questions, although recall was improved for the information which was related to the questions. (Author/RB)

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Question Production and Answering as an Aid to Prose Learning

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A number of studies have shown that providing questions or learning objectives along with text material improves the recall of information that is related to those adjunct aids (Frase, 1970; Rothkopf and Kaplan, 1972). In such studies, learning changes are dependent upon instructor interventions which require the learner to respond actively to the text. Perhaps this research can be extended to situations in which the learner himself constructs these aids. Engaging in such independent meaningful activities should provide the conditions for learning. Little research has been conducted on this problem in the context of prose learning (see Bernstein, 1973, for an extensive review).

This study explored whether subject-generated questions aid learning, and more specifically, whether the effective conditions of learning in this learner-controlled situation resemble those which occur when questions are instructor-imposed. Briefly, subjects in the present study engaged in tutorials in which they asked each other questions about a biographical passage. The questions were tape recorded so that an analysis could be conducted on various aspects of the learner-generated questions. With this data,

it was possible to map subjects' questions onto experimenter-constructed posttest items, and hence to explore problems concerning the recall of information which was relevant to or incidental to the subject-generated questions.

One general problem explored in this study was whether learner-produced questions would result in better recall than simply studying the text. Another general problem was whether the information relevant to the learner-produced questions would be remembered better than information which was incidental to those questions. In previous studies, in which adjunct questions and learning objectives have been used, relevant information has been better remembered than incidental information.

A more specific problem was whether a subject would learn more from generating questions than from answering them. A study by Myers, Travers and Sanford (1965) found that subjects who took the "teacher" role, in a paired-associates learning task, learned less than the "pupil". With text, however, the questioner is forced to decide what is relevant and what is incidental (by virtue of the fact that he must construct questions), hence for the questioner there should be a stronger constraint to carefully read all of the material than for the answerer (who could neglect the incidental information). It was predicted that questioners would recall more of the incidental information than answerers.

Finally, the topography of subjects' question-asking behavior was explored e.g.; the number of questions asked, which posttest questions were anticipated, whether there was a relationship between anticipating a posttest question and its difficulty.

Method

Subjects

Sixty-four high school seniors and juniors from schools in the local area were paid for their participation.

Materials

A 1218 word biographical passage about Nathaniel Bowditch (Bowditch, 1962) was used. The Flesch readability score of the passage was 48.33. The passage was divided into three sections, each approximately 400 words long. For a posttest, short answer questions were constructed which involved the recall of specific facts. Thirty questions for each of the three sections of the text were recorded on tape for the posttest, with 15 seconds allowed for a written response after each question.

Procedure

Forty-eight subjects, assigned to 24 pairs in the order in which they volunteered, were run. A printed booklet containing the passages and complete instructions was given to subjects. Subjects were told that they were to learn a biographical text for a later test, and that they would be tested on the entire text. It was explained that they would

be required to ask their partner questions on one third of the text, their partner would ask questions on another third of the text, and they would study on their own on another third. Subjects were told to ask questions which would help on a posttest, but no specific instructions were given about the number or type of questions which they were to generate or which they would receive on the posttest. Answerers were required to respond with as direct an answer as possible, without requests for additional clarification.

Each subject engaged in only one activity (e.g., asking or answering questions) on the first third of the text, then went on to the second third and engaged in an alternate activity, then to the last third and a different activity. Once having completed a section, subjects were not allowed to review. The order in which subjects engaged in questioning (Q), answering (A), and studying (S) was counterbalanced, yielding six such orders. Each subject engaged in only one of these activities on each section of the text. Subjects in a pair both engaged in condition S on the same section of text.

Subjects were seated across from each other in separate soundproof cubicles with a window opening between. Both subjects had copies of the complete text before them. Subjects went through the booklet at their own jointly determined pace. Each page contained instructions about what the subject was to do next. During questioning sessions

subjects were allowed to reply "yes" or "no" as feedback to the answer given by their partner. Subjects recorded the time from a digital clock when they began and after they completed each section of the reading passage. A tape recorder was kept running throughout the session.

Sixteen independent subjects engaged in condition S only (and they were run individually) in order to obtain an estimate of the relative difficulty of the test items under conditions in which subjects were not engaged in questioning.

After the experiment, subjects were given an answer sheet on which they wrote short answers to the 90 tape recorded posttest questions (which were given in the order in which that information had occurred in the text).

Two scorers independently evaluated a typed transcript of subjects' questions. For each posttest question, a decision was made as to whether that question could be answered on the basis of the questions (and related answers) that a particular subject-pair had generated. Posttest questions which were related to questions asked by a particular subject are referred to as T (targeted) items for that subject and his partner; those which were not related to questions generated by that subject-pair are referred to as NT (non-targeted) items. The correlation between the two raters' assignment of posttest items to these two categories was .95.

Design

The basic design was a 6x3 analysis of variance (six orders in which the conditions were administered, and the three Q, A, S conditions), with repeated measures on the last factor. In addition, various analyses were conducted, including comparisons of performance on T and NT posttest items for each subject for the Q and A conditions.

Results

Questions Generated by Subjects

The mean number of questions generated by subjects was 8.97 (SD=5.2; N=38)[1] per section of text, or one question every 1.68 sentences. The average probability that a post-test item would be targeted was .33, .33 and .37 for sections 1-3, respectively (SD's were .22, .19 and .23, respectively; N = 30 items). Thus, on the average each subject-generated question targeted 1.14 test items. There was evidence of intra-pair constraints on the number of questions asked. The correlation between the number of questions asked by subjects within a pair was .76 (N=19 pairs). The number of questions asked correlated significantly with the amount of time subjects spent studying alone (.43, N=38; $p < .01$), however neither time nor questions asked correlated significantly with recall in condition S.

More than 99% of the 341 questions generated by subjects required locating specific items of information, i.e., the vast majority of questions required verbatim answers.

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[1] Equipment failures made it impossible to transcribe five tapes.

Questioners expended 10.39 words per question, answerers expended 8.60 words per answer on the average.

There was no significant correlation between item difficulty and the probability of targeting (as ascertained by correlating the difficulty of each item obtained from the group of subjects who studied the entire passage with the percentage targeting an item in the Q condition). The correlations for the three sections of text were .21, -.07 and .17, respectively (N=30 items). In short, the salience of information was not related to its difficulty.

Recall Scores

Mean scores, for A, Q and S conditions were 54.1%, 52.4% and 46.8%, respectively; F (2,84) = 7.19, $p < .01$. Conditions A and Q differed from S (Neuman-Keuls test, $p < .01$), but not from each other. Mean proportion of T and NT items recalled for each subject is shown in Table 1. A one way analysis of variance comparing all means ($F(4,148) = 10.5$, $p < .001$) showed that recall on the two sets of T items was significantly higher than all other means, which did not differ from each other. Contrary to predictions, there was no interaction between performance on T and NT items and Q and A conditions.

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Insert Table 1 about here

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Time

Times for conditions A, Q and S were 7.99 min., 7.99 min. and 4.0 min.; $F(2,84) = 115.99$, $p < .001$. In short, subjects spent about twice as long on the passage (with a 16% overall improvement in learning) when they engaged in questioning or answering than they did if they studied on their own.

Summary and Discussion

This study contributes to three areas; 1) confirmation and extension of earlier research findings, 2) implications for practice, and 3) implications for further research.

Research on the use of adjunct questions was confirmed and extended in that questions were found to aid recall, -- except that in this study subjects themselves produced the questions. Consistent with earlier research, question-production and response improved recall primarily on posttest questions which were related to the subject-generated questions. Consistent with the findings of Rothkopf and Kaplan (1972), there was no evidence for depressed incidental learning as a consequence of these self-produced adjunct aids. It should be noted that although subjects expected to be tested over all the text, there were still substantial improvements in relevant (T items) learning.

For practice, the present findings suggest that student tutorials can be used effectively with text. Learning improvements occurred equally for questioners and answerers.

Such improvements may entail considerable time for the student (but a considerable savings in time for the instructor). The results also indicate how this process might be improved. For instance, about half of the subject-generated questions were related to easily recalled information. Subjects' questions also tended to be more general than the posttest questions (relating to 1.14 posttest questions). If subjects were to base questions only on difficult information, more of the time spent in adjunct activities would contribute to increases in recall. Further, only one-third of the text, on the average, was covered by subjects' questions. Increasing the range of this coverage should result in increased recall.

Problems for further research include whether subjects can discriminate difficult from easy material, and whether the criterion for performance can be manipulated through verbal instructions. There was evidence that subjects within a pair tended to produce equal numbers of questions. The questioning activities of the first member of a pair might function as a criterion for the other members' questioning, and this source of constraint should be further investigated. A study, designed to explore some of these problems, is now in the final stages of completion. The data should be available before the 1974 Annual Convention.

References

Bernstein, S. L. The effects of children's question-asking behavior on problem solution and comprehension of written material. Unpublished Doctoral Dissertation, Columbia University, 1973.

Bowditch, N. American practical navigator. Washington: U. S. Government Printing Office, 1962, pp. 3-5.

Frase, L. T. Boundary conditions for mathemagenic behaviors. Review of Educational Research, 1970, 40, 337-347.

Myers, K. E., Travers, R. M. W., & Sanford, M. E. Learning and reinforcement in student pairs. Journal of Educational Psychology, 1965, 56, 67-72.

Rothkopf, E. Z., and Kaplan, R. Exploration of the effect of density and specificity of instructional objectives on learning from text. Journal of Educational Psychology, 1972, 63, 295-302.

Table 1

Mean Proportions Correct on Posttest

	Condition		
Item	A	Q	S
Targeted (T)	.67	.70	
Non-Targeted (NT)	.49	.52	.50

Note. - N = 38